



## SCREENING OF CHILI GERMPLASM FOR RESISTANCE AGAINST APHID

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Received: 08 April 2021, Revised: 30 April 2021, Accepted: 08 May 2021

### ABSTRACT

The study was conducted with seventy germplasms of chili to find out suitable germplasm against aphid infestation. The screening of chili germplasm was done based on percentage of leaf infestation and incidence of aphid. The lowest level of leaf infestation was found in the germplasms AHM 219 (3.02%), AHM 223 (3.23%), IAH 156 (4.09%), RT 30 (4.86%), IAH 165 (4.92%) and AHM 141 (5.18%) and less incidence of aphid was found in the germplasms AHM 223 (2.48), IAH 156 (2.65), IAH 165 (2.65), AHM 219 (3.15), AHM 141 (3.32), AH 65 (3.90), RT 28(2) (4.48), IAH 162 (4.57), IAH 164 (4.82) and RT 30 (4.82). Therefore, these germplasms were considered as comparatively tolerant among the studied plant materials.

**Keywords:** *Capsicum sp.*, germplasm, *Myzus persicae*

### Introduction

Chili (*Capsicum sp. L.*), belongs to family Solanaceae, is one of the most important commercial vegetable and spice crops having pungency ingredient namely capsaicin (8-methyl-N-vanillyl-6-enamide) (Choudhary and Samadia 2004). Chili is a rich source of vitamin C, vitamin A, vitamin B and minerals (Singh 1998). The genus *Capsicum*, comprising more than 200 varieties and grouped into 30 species (Hernández *et al.* 1999). Aphid *Myzus persicae* (Hemiptera: Aphididae) is a serious pest of chili plant that causes enormous economic loss to chili production (Kumar *et al.* 2013). Chili yield losses due to aphid up to 65 percent (Hosmani 2007).

The prevalence and build-up of aphid on chili crop is mostly governed by weather parameters like temperature, relative humidity, rainfall, sunshine hours. Furthermore, the weather parameters vary greatly from place to place and season to season (Pareek 2008). For effective pest management, study on the influence of the various factors responsible for population fluctuation on a particular crop might assist in prediction of its occurrence in a given area. A number of morphotypes of chili are available in Bangladesh which are varying in habit, size, shape, color, pungency and yield which indicate their wide range of variability (Farhad *et al.* 2010). It is grown practically all over the country but the yield is comparatively low due to the lack of improved and resistant variety.

The selection of Chili resistant germplasm against aphids might be an important component for preparing an integrated pest management approach against this pest. Under these circumstances, an investigation was undertaken to find out resistant germplasm of chili against aphid as a component of integrated pest management approach.

### Materials and Methods

The study was conducted from October 2015 to May 2016 in the experimental field of Bangladesh Agricultural Research Institute (BARI), Gazipur. Seventy chili germplasms namely RT 42, RT 41, RT 36, RT 35, RT 34, RT 33, RT 31, RT 30, RT 29, RT 28(2), RT 28, AH 65, AH 27, AH 26, RT 43, RAI 04, RAI 50, IAH 40, IAH 44, IAH 156, IAH 160, IAH 161, IAH 162, IAH 163, IAH 164, IAH 165, IAH 176, IAH 178, AHM 180, AHM 166, AHM 141, AHM 132, AHM 123, AHM 118, AHM 102) were collected from the Plant Genetic Resource Center of BARI and the seedlings of the germplasms were raised in polythene bags. Thirty-five days old seedlings were transplanted in the experimental plots on 04 February 2016. Each germplasm was transplanted in a plot of 3 m × 2 m. Each plot constituted three rows having five pits. Row to row and plant to plant distance was 70 and 60 cm, respectively. Fertilizer doses were 10 ton/ha cowdung, 210 kg/ha Urea, 33 kg/ha TSP, 200 kg/ha MoP and

5 kg/ha Borax (Mondal *et al.* 2011). All the intercultural operations except management of insect pests were done on necessity. Experimental plots were monitored regularly and data of the incidence of aphid were recorded weekly.

For collecting data, three plants were randomly selected from each rows of the plot and the numbers of aphid per leaf of the plants were counted using magnifying glass. The number of infested leaf and total leaf of the apical 10 cm of the plants were counted and infestation level was calculated in percentage. The leaf infestation and aphid incidence data were recorded after 80, 100 and 120 days after transplanting (DAT) and graded according to Ahmed *et al.* (2010) into five categories (Resistance = no aphid

and infestation, Tolerant => 0.0 - 5.0 aphid and percent infestation, moderately tolerant = 5.1-15.0 aphid and percent infestation, susceptible = 15.1 – 25.0 aphid and percent infestation, and highly susceptible = 15.1 – 25.0 and percent infestation).

## Results and Discussion

Leaf infestation in different chili germplasm was recorded at 80 DAT, 100 DAT and 120 DAT (Table 1). The level of infestation at 80 DAT varied from 3.82 to 64.73% with an average of 27.60%. All the selected twigs were found infested among the germplasm. The lower leaf infestation (below 10%) was found in the germplasm of

**Table 1. Leaf infestation (%) of chili germplasms by aphid at different days after treatment (DAT)**

Genotype	80 DAT	100 DAT	120 DAT	Mean	Level of resistance
AH 26	17.3	11.1	0.5	9.6ab	Susceptible
AH 27	17.2	8.9	1.6	9.2ab	Susceptible
AH 65	9.2	9.2	3.1	7.2ab	Susceptible
AHM 132	32.3	21.2	1.5	18.3ab	Moderately Tolerant
AHM 102	25.3	10.3	1.0	12.2ab	Susceptible
AHM 118	14.5	9.1	1.7	8.4ab	Susceptible
AHM 123	12.3	8.4	2.5	7.8ab	Susceptible
AHM 141	9.2	5.7	0.6	5.2b	Highly Susceptible
AHM 166	8.6	7.9	3.2	6.6ab	Highly Susceptible
AHM 180	25.6	16.8	3.7	15.4ab	Moderately Tolerant
AHM 185	50.5	21.7	1.7	24.6ab	Moderately Tolerant
AHM 188	50.9	15.7	1.5	22.7ab	Moderately Tolerant
AHM 190	46.0	18.3	0.0	21.4ab	Moderately Tolerant
AHM 191	57.6	26.8	3.5	29.3ab	Moderately Tolerant
AHM 192	38.6	15.6	4.5	19.6ab	Moderately Tolerant
AHM 196	55.0	26.3	1.3	27.5ab	Moderately Tolerant
AHM 197	35.4	16.3	1.6	17.8ab	Moderately Tolerant
AHM 201	35.9	21.6	0.6	19.4ab	Moderately Tolerant
AHM 204	60.9	23.2	5.6	29.9ab	Tolerant
AHM 206	58.8	27.2	3.0	29.7ab	Tolerant
AHM 217	9.2	7.0	2.4	6.2ab	Highly Susceptible
AHM 219	5.5	3.5	0.0	3.0b	Highly Susceptible
AHM 223	3.8	4.6	1.3	3.2b	Highly Susceptible
AHM 225	15.9	5.7	1.4	7.7ab	Susceptible
AHM 227	53.3	23.5	1.0	25.9ab	Moderately Tolerant
AHM 228	60.3	28.5	1.8	30.2ab	Tolerant
AHM 231	38.2	19.1	2.0	19.8ab	Moderately Tolerant

Table 1. Continued.

Genotype	80 DAT	100 DAT	120 DAT	Mean	Level of resistance
AHM 244	46.5	18.3	0.0	21.6ab	Moderately Tolerant
AHM 245	52.6	30.1	3.6	28.8ab	Moderately Tolerant
AHM 246	22.9	17.3	1.2	13.8ab	Moderately Tolerant
AHM 248	29.8	20.5	2.5	17.6ab	Moderately Tolerant
AHM 251	20.1	12.8	1.2	11.3ab	Susceptible
AHM 253	31.3	15.0	2.7	16.3ab	Moderately Tolerant
AHM 254	32.6	16.5	1.3	16.8ab	Moderately Tolerant
AHM 257	29.2	21.4	2.0	17.5ab	Moderately Tolerant
AHM 258	17.0	11.0	1.2	9.7ab	Susceptible
AHM 259	16.8	8.0	2.8	9.2bab	Susceptible
AHM 266	22.0	14.4	2.0	12.8ab	Susceptible
IAH 156	7.0	5.2	0.0	4.0b	Highly Susceptible
IAH 160	55.2	30.5	3.0	29.6ab	Moderately Tolerant
IAH 161	38.0	15.5	2.8	18.8ab	Moderately Tolerant
IAH 162	10.8	8.3	1.8	6.9ab	Highly Susceptible
IAH 163	27.1	18.2	4.8	16.7ab	Moderately Tolerant
IAH 164	8.8	7.7	1.2	5.9ab	Highly Susceptible
IAH 165	9.1	5.7	0.0	4.9b	Highly Susceptible
IAH 176	13.0	9.1	3.2	8.4ab	Susceptible
IAH 178	19.1	12.3	0.0	10.5ab	Susceptible
IAH 182	25.4	17.2	1.6	14.7ab	Moderately Tolerant
IAH 191	17.3	11.2	1.3	9.9ab	Susceptible
IAH 278	18.2	12.5	2.0	10.9ab	Susceptible
IAH 291	59.3	27.5	0.5	29.1ab	Moderately Tolerant
IAH 307	63.4	29.1	0.8	31.0ab	Tolerant
IAH 311	22.5	11.3	2.1	12.0ab	Susceptible
IAH 312	64.7	40.5	2.3	35.8a	Tolerant
IAH 40	30.5	15.1	3.1	16.2ab	Moderately Tolerant
IAH 44	28.3	18.4	3.4	16.7ab	Moderately Tolerant
RAI 04	29.6	14.5	2.0	15.4ab	Moderately Tolerant
RAI 50	30.0	17.4	2.8	16.7ab	Moderately Tolerant
RT 28	14.5	26.1	5.1	15.2ab	Moderately Tolerant
RT 28(2)	16.6	10.4	0.9	9.3ab	Susceptible
RT 29	18.0	11.7	2.8	10.8ab	Susceptible
RT 30	8.0	5.4	1.2	4.9ab	Highly Susceptible
RT 31	9.3	7.4	1.9	6.2ab	Highly Susceptible
RT 33	10.5	9.3	2.9	7.6ab	Susceptible
RT 34	15.1	14.2	2.0	10.5ab	Susceptible
RT 35	11.8	9.3	2.5	7.9ab	Susceptible
RT 36	17.8	12.4	1.1	10.4ab	Susceptible
RT 41	29.0	19.5	1.5	16.7ab	Moderately Tolerant
RT 42	10.2	9.5	2.7	7.5ab	Susceptible
RT 43	26.1	21.6	2.5	16.7ab	Moderately Tolerant

**Table 2. Incidence of aphid (number/twig) in chili germplasms at different days after treatment (DAT)**

Genotype	80 DAT	100 DAT	120 DAT	Mean	Level of resistance
AH 26	11.5	9.4	0.3	7.0bcd	Moderately Tolerant
AH 27	25.8	17.0	1.3	14.7abcd	Moderately Tolerant
AH 65	3.2	6.2	2.3	3.9d	Tolerant
AHM 102	15.5	11.5	0.5	9.2bcd	Moderately Tolerant
AHM 118	6.7	7.5	1.5	5.2d	Moderately Tolerant
AHM 123	11.7	9.8	1.0	7.5bcd	Moderately Tolerant
AHM 132	20.5	14.3	1.2	12.0bcd	Moderately Tolerant
AHM 141	3.8	5.6	0.5	3.3d	Tolerant
AHM 166	9.3	10.0	3.8	7.7bcd	Moderately Tolerant
AHM 180	9.3	9.0	1.8	6.7bcd	Moderately Tolerant
AHM 185	52.2	30.0	0.8	27.7abcd	Highly Susceptible
AHM 188	45.8	26.6	0.5	24.3abcd	Susceptible
AHM 190	33.2	20.0	0.0	17.7abcd	Susceptible
AHM 191	42.5	25.6	1.8	23.3abcd	Susceptible
AHM 192	26.7	17.8	2.0	15.5abcd	Susceptible
AHM 196	36.0	21.6	0.3	19.3abcd	Susceptible
AHM 197	34.0	20.8	0.7	18.5abcd	Susceptible
AHM 201	44.7	25.9	0.2	23.6abcd	Susceptible
AHM 204	79.3	44.7	3.2	42.4a	Highly Susceptible
AHM 206	66.3	37.7	2.2	35.4ab	Highly Susceptible
AHM 217	7.8	8.2	1.7	5.9cd	Moderately Tolerant
AHM 219	4.0	5.5	0.0	3.2d	Tolerant
AHM 223	2.2	4.8	0.5	2.5d	Tolerant
AHM 225	12.7	10.1	0.7	7.8bcd	Moderately Tolerant
AHM 227	44.3	26.1	1.0	23.8abcd	Susceptible
AHM 228	56.7	32.0	0.5	29.7abcd	Highly Susceptible
AHM 231	31.0	19.6	1.3	17.3abcd	Susceptible
AHM 244	38.2	22.5	0.0	20.2abcd	Susceptible
AHM 245	24.8	17.0	2.3	14.7abcd	Moderately Tolerant
AHM 246	19.7	13.5	0.5	11.2bcd	Moderately Tolerant
AHM 248	19.3	14.2	2.2	11.9bcd	Moderately Tolerant
AHM 251	30.7	19.4	1.2	17.0abcd	Susceptible
AHM 253	19.7	13.8	1.0	11.5bcd	Moderately Tolerant
AHM 254	26.2	16.7	0.3	14.4abcd	Moderately Tolerant
AHM 257	32.3	20.5	1.7	18.2abcd	Susceptible
AHM 258	13.7	10.5	0.3	8.2bcd	Moderately Tolerant
AHM 259	13.2	11.0	1.8	8.7bcd	Moderately Tolerant
AHM 266	14.0	11.1	1.3	8.8bcd	Moderately Tolerant
IAH 156	3.0	5.0	0.0	2.7d	Tolerant
IAH 160	42.0	25.1	1.3	22.8abcd	Susceptible
IAH 161	23.5	16.0	1.5	13.7abcd	Moderately Tolerant
IAH 162	6.3	6.9	0.5	4.6d	Tolerant

Table 2. Continued.

Genotype	80 DAT	100 DAT	120 DAT	Mean	Level of resistance
IAH 163	23.2	17.6	5.2	15.3abcd	Susceptible
IAH 164	6.5	7.1	0.8	4.8d	Tolerant
IAH 165	3.0	5.0	0.0	2.7d	Tolerant
IAH 176	8.5	8.8	2.2	6.5bcd	Moderately Tolerant
IAH 178	15.7	11.3	0.0	9.0bcd	Moderately Tolerant
IAH 182	28.8	18.1	0.5	15.8abcd	Susceptible
IAH 191	12.0	10.0	1.2	7.7bcd	Moderately Tolerant
IAH 278	13.2	11.3	2.5	9.0bcd	Moderately Tolerant
IAH 291	67.3	37.5	0.7	35.2abc	Highly Susceptible
IAH 307	54.0	30.5	0.2	28.2abcd	Highly Susceptible
IAH 311	22.8	15.5	1.2	13.2abcd	Moderately Tolerant
IAH 312	54.3	31.5	1.8	29.2abcd	Highly Susceptible
IAH 40	18.0	13.4	1.8	11.0bcd	Moderately Tolerant
IAH 44	27.0	17.9	1.8	15.6abcd	Susceptible
RAI 04	9.8	8.9	1.0	6.6bcd	Moderately Tolerant
RAI 50	16.0	12.2	1.5	9.9bcd	Moderately Tolerant
RT 28	18.3	14.9	4.5	12.6bcd	Moderately Tolerant
RT 28(2)	6.5	6.8	0.2	4.5d	Tolerant
RT 29	12.7	10.4	1.2	8.0bcd	Moderately Tolerant
RT 30	5.8	7.1	1.5	4.8d	Tolerant
RT 31	10.0	9.4	1.8	7.0bcd	Moderately Tolerant
RT 33	11.3	10.2	2.2	7.9bcd	Moderately Tolerant
RT 34	14.0	11.6	2.3	9.3bcd	Moderately Tolerant
RT 35	14.8	11.7	1.7	9.4bcd	Moderately Tolerant
RT 36	19.0	13.5	1.2	11.2bcd	Moderately Tolerant
RT 41	14.3	11.5	1.7	9.2bcd	Moderately Tolerant
RT 42	7.7	8.1	1.7	5.8d	Moderately Tolerant
RT 43	22.7	15.4	1.2	13.0bcd	Moderately Tolerant

AHM 223, AHM 219, IAH 156, RT 30, AHM 166, IAH 164, IAH 165, AHM 217, AHM 141, AH 65 and RT 31. At 100 DAT, the level of infestation varied from 3.54 to 40.51% with an average of 15.46%. The lower level of leaf infestation (<10%) was found in the germplasm of AHM 219, AHM 223, IAH 156, RT 30, AHM 141, AHM 225, IAH 165, AHM 217, RT 31, IAH 164, AHM 166, AHM 259, IAH 162, AHM 123, AH 27, AHM 118, IAH 176, AH 65, RT 35, RT 33, RT 42. At 120 DAT, the level of leaf infestation varied from 0.00 to 5.56% with an average of 1.98% which was also statistically different. No leaf infestation was found in the germplasm of AHM 190, AHM 219, AHM 244, IAH 156, IAH 165 and IAH 178. The lowest level of leaf infestation (< 1.00%) by

aphid was found in the germplasm of AH 26, IAH 291, AHM 201, AHM 141, IAH 307, RT 28(2) and AHM 227. Considering the mean leaf infestation by aphid in chili germplasm the lowest level of leaf infestation was found in the germplasm AHM 219 (3.02%), AHM 223 (3.23%), IAH 156 (4.09%), RT 30 (4.86%), IAH 165 (4.92%) and AHM 141(5.18%) which were significantly different from all other germplasm and occupied 70<sup>th</sup>, 69<sup>th</sup>, 68<sup>th</sup>, 67<sup>th</sup>, 66<sup>th</sup> and 65<sup>th</sup> position in the rank order aphid susceptibility. Therefore, these are considered as resistant genotype of the germplasm.

Incidence of aphid in different chili germplasm was also recorded at 80 DAT, 100 DAT and 120 DAT. The

**Table 3. Summary of the cluster of the germplasms**

Cluster	Cluster of the germplasms	Cluster size	Category
Cluster 1	AHM 185, AHM 188, AHM 190, AHM 191, AHM 192, AHM 196, AHM 197, AHM 201, AHM 227, AHM 231, AHM 244, AHM 245, AHM 254, AHM 257, IAH 160, IAH 161, IAH 163, IAH 182, IAH 44.	19	Highly Susceptible (HS)
Cluster 2	AH 26, AH 65, AHM 118, AHM 141, AHM 166, AHM 217, AHM 219, AHM 223, AHM 225, AHM 258, AHM 259, IAH 156, IAH 162, IAH 164, IAH 165, IAH 176, IAH 191, RT 28(2, RT 30, RT 31, RT 33, RT 35, RT 42.	23	Susceptible (S)
Cluster 3	AH 27, AHM 132, AHM 102, AHM 123, AHM 180, AHM 246, AHM 248, AHM 251, AHM 253, AHM 266, IAH 178, IAH 278, IAH 311, IAH 40, RAI 04, RAI 50, RT 28, RT 29, RT 34, RT 36, RT 41, RT 43.	22	Moderately Tolerant (MT)
Cluster 4	AHM 204, AHM 206, AHM 228, IAH 291, IAH 307, IAH 312.	6	Tolerant (T)

rate of aphid incidence at 80 DAT varied from 2.17 to 79.33 individual with an average of 22.86. The lower occurrence (< 5 number of aphids per twig) was observed in the germplasm of AHM 223, IAH 156, IAH 165, AH 65, AHM 141 and AHM 219. At 100 DAT, the rate of aphid incidence varied from 4.78 - 44.70 individual with an average of 15.53. The lower aphid infestation was found in the germplasm of AHM 223, IAH 156 and IAH 165 having less than 5 individuals per twig. At 120 DAT, the rate of aphid incidence was observed comparatively less in number than other DATs. The rate from varied from 0.00 - 5.17 individuals with an average of 1.30. No aphid incidence was observed in the germplasm of IAH 156, IAH 165, AHM 219, IAH 178, AHM 190 and AHM 244. The maximum aphid incidence was observed in the germplasm of AHM 204, AHM 166 and RT 28 having more than 3 individuals per twig. Considering the mean aphid incidence in chili germplasm, the lower level of aphid incidence was found in the germplasm AHM 223, IAH 156, IAH 165, AHM 219, AHM 141, AH 65, RT 28(2), IAH 162, IAH 164 and RT 30 and occupied 61<sup>th</sup> -70<sup>th</sup> position in the rank order aphid susceptibility. Therefore, these are considered as resistant germplasm among the plant material. Lavlesh *et al.* (2020) reported in uttar Pradesh in India that seventy germplasms/varieties were transplanted in the month of 10 September 2017, and maintained upto their maturity of the crop. Among 70 germplasm, none germplasm were found immune against thrips and aphids, 5 germplasm were found highly resistant, 10 germplasm were found moderately resistant, 12 germplasm were found low resistant, 19 germplasm were found less susceptible, 15 germplasm were found moderately susceptible and 9 germplasm were found highly susceptible. (Lavlesh *et al.* 2020).

The cluster analysis grouped the germplasm into four clusters with tolerant, moderately tolerant, susceptible and highly susceptible germplasm. The clustering was more or less similar to the level resistance category those were found based on leaf infestation and aphid incidence. None of the germplasm was found resistance to aphid infestation but six accessions were found comparatively tolerant to aphid infestation viz. AHM 204, AHM 206, AHM 228, IAH 291, IAH 307 and IAH 312. These germplasms are identified as good sources of resistance against aphid infestation. The results showed that there is considerable variation for resistance to aphid in chili (*Capsicum*) that can be exploited in resistance breeding programs and also further genetic studies related to varietal development for aphid resistance to chili. Rameash reported that among the 71 accessions screened, four (IC342390, IC572492, IC337281 and IC344366) were identified as resistant; 12 were found to be moderately resistant; 39 were susceptible and 16 were highly susceptible to the infestation of *P. latus*. Among the 12 moderately resistant accessions, three each were sourced from Kerala (IC344385, IC344367 and IC344364) and Himachal Pradesh (IC537657, IC537658, and IC537661); two each from Haryana (IC342449 and IC342464) and Uttarakhand (IC537599 and IC537583) and one each from Gujarat (IC330969) and Karnataka (IC572454). (Rameash *et al.* 2015).

Earlier studies also reported a considerable variability within chili germplasms in the response to aphids (Babu *et al.* 2002, Satpathy *et al.* 2008, Kumar *et al.* 1996). This study also supported the ranking of resistance reported by (Maharijaya *et al.* 2011) in Indonesia. Therefore germplasms belong to cluster 4 are considered a tolerant ones.

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